indefinite boundary of the ranges, the differences elsewhere are so strongly marked and consistent that it seems advisable to distinguish the two by name. The variety is plentiful throughout most of Oregon east of the Cascades from northern Klamath and Lake counties northward and eastward.

Willamette University,
Salem, Oregon,
March 25, 1940.

FIELD CHARACTERS DISTINGUISHING PINUS PONDEROSA AND PINUS JEFFREYI

Kenneth E. Bradshaw[1]

Western conifers offer relatively few problems in taxonomic differentiation to the field man, but one frequent source of confusion and controversy lies in the similarity between the common western yellow pine (ponderosa pine), *Pinus ponderosa* Dougl. ex Laws. and its close relative Jeffrey pine, *Pinus Jeffreyi* Grev. and Balf. ex A. Murr. These species may be found occupying separate ecological niches (Jeffrey pine has a higher elevational range and occurs on drier sites than western yellow pine and will replace it on serpentine formations at the lower elevations) or they may be found growing intermixed. While certain typical stands or individual trees may be quite readily identified, others defy identification by the use of a simple key and generalized descriptions of the species in question. The following pages contain a list of comparative external features which should greatly facilitate the separation of the two species in the field. Remarks on segregations based on the internal structural and chemical qualities of the wood and foliage, which are essentially tasks for the laboratory, have not been included. Grateful acknowledgement is made of certain technical assistance given the writer by Mr. Lloyd Austin of the California Forest and Range Experiment Station.

When using these comparisons, it must be remembered that it is seldom adequate to attempt to identify a tree by using one character to the exclusion of the others. Numerous local strains with distinct morphological and physiological differences result in extreme variation. Certain trees have characters of both species, due probably to cases of inter-breeding. At times but one feature, such as characteristic cones beneath an isolated tree, or distinctly brownish inner bark scale surfaces, may be used as a primary distinction which would point to a Jeffrey pine. Certain trees, however, which otherwise resemble western yellow pine have cones similar to those of the Jeffrey pine or the brownish inner bark scale surfaces characteristic of that species. There-

[1] Junior Range Examiner, Soil Conservation Service, United States Department of Agriculture, Berkeley, California (Formerly Assistant to Technician, California Forest and Range Experiment Station, Berkeley).

Young Trees

Pinus ponderosa	*Pinus Jeffreyi*
Foliage: texture relatively fine, yellow-green, glossy; striae of stomata fine, scarcely distinguishable.	Foliage: needles thicker, longer, coarser, blue-green; powdery white because of the prominent striae of stomata which are well defined and readily counted.
Leader: flaky bark high on slender leader, length of roughened new growth short; dull gray; resin-filled pustules none.	Leader: flaky bark not extending so high on the somewhat stouter leader, leaving conspicuous long, smooth, silvery gray area; resin-filled pustules numerous.
Buds: orange or brick red, conic-ovate, acute; scales closely appressed, surface with resinous exudations, generally in form of numerous tiny droplets.	Buds: darker with purple or chocolate brown tone; somewhat stouter, more elongate, less acute; scales without resinous exudations, tips less closely appressed.
Twigs: surface of season's growth shinging green, previous years' growth brownish.	Twigs: surface of season's growth green, glaucous or pruinose; previous years' growth brownish or greenish but retaining the bloom in perceptible density.
Bark: soft, somewhat resinous; ridges wide, not much inter-connected; furrows shallow, flaky with bark scales; varying from blackish to yellow-brown, tawny or dull orange; inner surfaces of bark scales powdery dull to brilliant sulphur-yellow.	Bark: hard, non-resinous; ridges narrow, irregularly connected giving a braided appearance; furrows deep, distinct, not flaky, laminations of bark very distinct on edges; generally dark gray with slight purplish or reddish-brown cast; inner surfaces of bark scales creamy pinkish- or chocolate-brown.

fore a dominance of one group of characters over the other must be the basis for establishing an identification, unless the tree in question represents a typical case of direct hybridization.

The writer has found that certain characters are best used in the identification of young trees, while others are more serviceable in segregating the older trees. With this consideration in mind, there have been set up practical groups of data for each of these two broad age classes. Trees of intermediate age may be identified by the use of either one of the groups or parts or all of both. Variations in the presence and quality of significant factors with age, size, and condition of the individual trees must be taken into account when using the descriptions contained in this paper. In evaluating the characters of special structures the following modifying conditions should be noted:

Foliage. Foliar differences have been found useful only with the smaller pole-size and seedling trees; they are best used when the two species are growing intermixed so that relative comparisons can be made.

Twigs. Color of the twigs or previous years' growth has been found to be exceptionally constant as a distinguishing feature; it

Old Trees

Pinus ponderosa	*Pinus Jeffreyi*
Foliage: often perceptibly yellowish; relatively sparse, in ball-like tufts at ends of branchlets, needles persisting approximately 3 years.	Foliage: somewhat blue-green, darker; more dense, needles slightly longer and coarser, persisting 5 to 8 years.
Bark: generally tawny, yellow-brown or dull orange; inner surface of scales, especially near ground level powdery dull to brilliant sulphur-yellow, frequently a distinctive and reliable character; interior of scale brown or tan; scales somewhat soft, a small piece usually dislodged when lightly struck with fingernail; small dark resin pits present throughout.	Bark: externally, color similar to that of *P. ponderosa,* or dark reddish brown, or wine color; plates similar to those of *P. ponderosa* or in more typical specimens somewhat narrower with deeper separating grooves; inner surface of scale light creamy pinkish- or chocolate-brown; interior of scale deep reddish; scales more glossy, harder, merely dented when lightly struck with fingernail; resin pits lacking.
Odor: slight, resinous.	Odor: rather strong, pleasant, sweet, described as resembling that of pineapple, mellow apple, vanilla, or violet.
Limbs: stout, often grotesquely gnarled and bent in very old trees; comparatively short, straight and stout in younger mature specimens, sometimes slightly upturned at ends.	Limbs: less stout and angled, often slender, elongate, more distinctly upturned at ends in typical specimens; retained on bole somewhat longer, resulting in a longer, more symmetrical crown.
Cones: somewhat ovate; about 3–6 inches long, the spreading scales appearing slender and widely spaced; prickles short, the points over most of the cone protruding outward from the umbos, often hooklike, evident to the touch.	Cones: elliptical or long-oval, resembling an old-fashioned bee-hive; about 6 to 10 inches long, scales relatively more numerous, stout, closely compacted, projecting almost horizontally from the cone axis, thus appearing heavier and denser; prickles long, mostly deflexed, the points straight or even slightly turned in, seldom protruding outward except sometimes on the upper 4 to 5 whorls of scales, scarcely perceptible to the touch.

is the only reliable means for determining the species of very young seedlings.

Bark. Ridge and furrow characters are rather distinctive but hard to see on very small trees just beginning to form bark, and not so apparent on trees over sixteen inches in diameter at approximately breast height.

Odor. The use of odor in identification is best employed on older trees, but may be found helpful to supplement the appearance of the bark in young trees which are beyond the stage where the leader and foliage color can be relied upon. Certain individuals of *Pinus ponderosa* and *Pinus Jeffreyi* have disturbingly similar odors, and since hybrids become chemically as well as physically intermixed, this feature should not be relied upon solely. Variation in olfactory sensitivity among observers also decreases the value of this method of differentiation.

Cones. Unopened cones of both species are quite as useful for identification as the opened cones. The immature cones of *Pinus ponderosa* are generally green in color, while the cones of *Pinus Jeffreyi* are generally purple, but there are so many variations and reversals of this rule that color should not be considered an identifying feature in all localities. Cone lengths are also variable, departing from the approximations presented here to such an extent that, except for specimens showing extremes of size, they should be considered much less reliable than the other features mentioned.

Soil Conservation Service,
United States Department of Agriculture
Berkeley, California, December, 1939.

A NEW SPECIES OF ASTRAGALUS FROM ARIZONA[1]

C. L. Porter

Astragalus Beathii sp. nov. Radix perennis; caules plurimi, 4–6 dm. longi, striati seu sulcati, glabri; folia 10–15 cm. longa, foliolis 11–21, plerumque oppositis, nunc ellipticis, obtusis, nunc ovato-obcordatis, basi in petiolulum perbrevem attenuatis; racemi 10 ad 20 flori, floribus densis, purpurascentibus; calyx oblongus, pilis albis, dentibus brevibus lanceolato-subulatis; vexillum ovatum, attenuatum, obtusum, fere 22 mm. longum; carina obtusa; legumen cartilagineum, glabrum, fere 3–4 cm. longum, oblongi-cylindraceum, semibiloculare, polyspermum, sutura superiore obtusa, inferiore introflexa; legumen, sectione transversa, rotundum videatur; semina reniformia, fere 3 mm. longa.

Plants perennial, many stemmed from the summit of a strong taproot, the stems erect, glabrous, striate to sulcate; leaves pinnately 11- to 21-foliolate, 10–15 cm. long, strigose when young, becoming glabrate when mature; leaflets varying from elliptical and obtuse in upper leaves to ovate-obcordate in basal leaves, those of the basal leaves often much smaller, subopposite on the rachis, and narrowed below into a very short petiolule; racemes 10- to 20-flowered, the flowers dense, purple; calyx oblong, white-strigose, the teeth short lance-subulate, about one-third the length of the tube; banner ovate, attenuate at base, obtuse at apex, about 22 mm. long, moderately arched; keel obtuse; legume coriaceous when mature, fleshy when young, sessile or subsessile, glabrous, about 3–4 cm. long, 7 mm. wide and thick, oblong-cylindrical, rounded in cross section, the upper suture obtuse, not prominent, the lower suture intruded and forming a thick septum about 2 mm. high within; seeds numerous, reniform, about 3 mm. long.

---

[1] Contribution no. 181 from the Department of Botany and the Rocky Mountain Herbarium of the University of Wyoming, Laramie.